

**SECTION 73****PUMPS**

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**73.1 REFERENCES**

(73A) OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION - OSHA 1910 –  
Subpart O – *Machinery and Machine Guarding*

(73B) OSHA Publication 3067 *Concepts and Techniques of Machine Safeguarding*

(73C) Washington Administrative Code, CH 296-24, Part C, *Machinery and Machine Guarding*

**73.2 INTRODUCTION**

This Section contains the Contractor Design and Provide general requirements for pumps. Requirements for pump systems are contained in other Sections of the Technical Specification.

***For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.***

### 73.3 SELECTION OF EQUIPMENT

Pumps shall be of a high commercial marine standard built in accordance with the standards of the Hydraulic Institute and meet all Authoritative Agency requirements.

The number of different types of pumps and manufacturers shall be minimized. Pumps for the same service and capacity shall be identical.

Unless otherwise specified, pumps shall be close coupled and horizontally mounted. Vertically mounted pumps may be used **only** with prior written approval of the WSF Representative for those areas where access for maintenance and operation is impaired on a “case-by-case” basis. Long-coupled pumps shall have the pump and its driver mounted on a common base of rugged extra heavy steel construction. Pump bases shall be strong enough to maintain the required coupling alignment. Dowels or fitted bolts shall be used where necessary to insure proper alignment.

Pumps of identical design shall have the same rotation and be to the same hand.

To the maximum extent practicable, all pumps shall be provided with face type mechanical seals. All seals shall be of the same manufacturer as that of the pump.

Where applicable, flexible shaft couplings shall be as manufactured by DODGE PARAFLEX, or equal.

Pumps shall be sized to serve connected systems, machinery and equipment during all service conditions.

In general, pumps shall be equipped with oil reservoir type bearings or with sealed ball bearings contained in housings and removable as a unit with the pump shaft. Where water jacketing is supplied, jackets shall be formed by cored casting with no joints to allow water leakage into the bearings. Bearing water shields or slingers shall be provided.

Unless otherwise specified, all pump connections 1½ inch and over shall be flanged in accordance with ANSI standards.

Fire pumps shall be capable of parallel operation. Each pump shall have a characteristic curve such that at constant rated speed, the total head at shut-off is not less than 10-percent ( $\geq 10\%$ ) and not more than 20-percent ( $\leq 20\%$ ) above rated total head at rated capacity.

Centrifugal pumps that will operate at or near shut-off during a service condition shall have means for re-circulation. As a minimum, fire pumps shall be furnished with re-circulation. The amount of re-circulation shall be sufficient to prevent overheating of the pump when operating at shutoff and to prevent vaporization of the liquid being pumped.

Suction and discharge nozzles shall be at least equal to ANSI standards for flange diameter and thickness and shall have ANSI standard drilling. All pump connections 1½ inches and above shall be flanged.

**73.4 INSTALLATION**

Location of pumps, together with piping design, arrangement and pump speed shall provide the highest practicable Net Positive Suction Head (NPSH) available for the pumps.

See Section 74 of the Technical Specification for general piping and material requirements.

In general, pumps and motors shall be mounted above the deck plates and have clear access for repair and removal of the units with appropriate rigging. WSF Representative written approval shall be obtained prior to locating pumps and motors below the deck plates.

For cast iron parts of pumps in corrosive services which require disassembly when servicing pumps, stainless steel through-bolts or studs shall be used instead of tap bolts. In general, the use of stainless steel through-bolts or studs will be used for securing pump parts when thread corrosion or seizure may be expected in service.

All pumps shall be provided with drip pans. Drip pans shall be fabricated from 11 gage stainless steel with a two (2) inch high coaming, approximately six (6) inch wide open area around the pump base and ½ inch NPT plugged drain.

Each pump shall have a pressure gage connected on the discharge side and a compound pressure gage on the suction side, installed to meet the requirements of Section 85 of the Technical Specification. Suitable provisions shall be made for using a portable tachometer for determining the speed of motor driven pumps.

Casings for rotating pumps, except for small, motor driven, close-coupled pumps, shall be split so that the rotor can be removed without disturbing the driver or the suction and discharge connections. Pump components with large mating surfaces shall be properly doweled and provided with jacking bolts for breaking joints. A vent shall be located at the top of the casing and a drain at the bottom.

Heavy pump components shall be made such that lifting gear can be attached.

Where possible, pumps shall be balanced hydraulically. All pumps shall be equipped with suitable thrust bearings to absorb any thrust which may occur during operation.

Pumps shall be designed and installed to have positive suction either through submergence, foot valves, or priming systems as appropriate, in order that pump operation is immediate and positive. Fire pumps shall have positive suction through submergence only, while taking into account probable angles of Vessel trim and list.

All pumps shall be provided with appropriate electrical power. Pump motors, controls and circuit protection shall be in accordance with Section 91 of the Technical Specification. Automatic control switches, pressure, level sensing, speed control, etc., shall be provided to suit the particular service.

Pumps which are to be supplied as an integral part of other equipment are not specified in this Section of the Technical Specification. These include the Steering Gear, elevator

1 machinery, Rescue Boat davit, fuel oil purifier, hydraulic watertight doors and integral diesel  
2 engine gear and motor driven pumps. Refer to the appropriate Section of the Technical  
3 Specification for additional pump requirements.

4 To prevent distortion caused by relative movement between vertical and horizontal  
5 structures, vertical pumps shall be supported either by a horizontal foundation or from a  
6 vertical structure, but they shall not be jointly supported by a horizontal foundation and a  
7 vertical structure. On horizontal units, the pump and its driver shall be mounted on a  
8 common base of rugged construction arranged with suitable drip-lip or drain pan  
9 construction. A connection for draining the base plate shall be tapped in a raised lip for  
10 horizontal connection to a drain header.

11 Relief valves for positive displacement pump discharges shall be located to protect both  
12 pump and system from overpressure.

### 13 **73.5 CENTRIFUGAL PUMPS**

14 Centrifugal pumps shall be selected to operate at or near the maximum efficiency point on  
15 the head-capacity curve and shall have non-overloading power characteristics. The motor  
16 horsepower rating shall at least equal the maximum operational requirement of the pump at  
17 rated speed, with sufficient margin for probable pump run-out conditions. The Contractor  
18 shall pay particular attention to all possible operating scenarios for fire pumps.

19 Where centrifugal pumps are required to operate in parallel, or take suction from different  
20 sources and discharge into a common line, their characteristics shall be such that each pump  
21 will carry its appropriate share of the load.

22 All coupled pumps shall be directly connected to drivers through flexible couplings for  
23 horizontal units and flexible or rigid couplings for vertical pumps.

24 Close-coupled motor driven pumps shall be suitable for either horizontal or vertical  
25 installation. Each pump/motor set shall be mounted on a common shaft, fully protected  
26 against wear and corrosion. Suction piping connected to this type of pump shall be arranged  
27 so the impeller can be removed without disturbing the suction cut-out valve.

28 Casings shall have openings of adequate size at the top for venting and shall have a low-point  
29 drain.

30 Mechanical seals with an external water supply shall not be acceptable.

31 Mechanical seal internals for seawater pumps shall be constructed of monel. Elastomers  
32 such as bellows and O-rings shall be made of fluorocarbon (VITON) material.

33 Pumps handling black and gray water shall have double mechanical seals with spring  
34 pressurized sealing oil chamber.

1 All centrifugal pumps shall be designed and built in accordance with ASTM F998. Any  
2 exceptions to the above requirement shall have **prior** written approval of the WSF  
3 Representative.

#### 4 **73.6 POSITIVE DISPLACEMENT PUMPS**

5 Preferably, pumps shall be direct-coupled to motors. However, where necessary, they may  
6 be provided with reduction gears, flexible couplings and supports for drives. The entire unit  
7 shall be a rigid (palletized) assembly to ensure close and permanent alignment. Where the  
8 pump is internally lubricated by the fluid pumped, wearing parts shall be of design and  
9 materials such that the pump may be operated safely when pumping liquids without  
10 lubricating characteristics.

11 Casings shall be designed so that operating parts may be dismantled without disturbing the  
12 suction or discharge connections. All connecting suction parts requiring alignment shall be  
13 taper doweled.

#### 14 **73.7 MACHINE GUARDING**

15 The Contractor shall design and provide readily removable guards for all rotating machinery,  
16 power-transmission machinery, and other machinery where necessary to prevent personnel  
17 from contacting moving parts. Equipment hazards to be guarded shall include, but are not  
18 limited to, flywheels, fans, couplings between motors and pumps, chain and sprockets, and  
19 V-Belt drives. The Contractor is responsible for ensuring that all machinery is guarded or  
20 protected in accordance with References (73A), (73B), and (73C). Where proper guarding is  
21 not provided by the equipment manufacturer, the Contractor shall be responsible for  
22 providing proper guarding for all equipment. See the *MACHINE GUARDING* Subsection in  
23 Section 50 of the Technical Specification.

24 Guards shall be bolted to the machine bases or foundations utilizing corrosion resistant studs,  
25 bolts, washers, and nyloc type nuts.

#### 26 **73.8 SPARE PARTS AND INSTRUCTION MANUALS**

27 Provide a list of recommended spare parts and special tools for those items which are  
28 Contractor furnished, together with parts lists and instruction manuals necessary to maintain  
29 and service the provided equipment and accessories in accordance with the requirements of  
30 Sections 86 and 100 of the Technical Specification.

#### 31 **73.9 TESTS, TRIALS AND INSPECTIONS**

32 All pump/motor assemblies shall be shop tested to demonstrate required performance, and  
33 internally excited vibration limits in accordance with Figure 2 – Maximum Allowable  
34 Vibration, Type 2 of MIL-STD-167-1. A certified copy of the shop test report, maximum

1 vibration values and pump performance curves shall be furnished to the WSF Representative  
2 with each pump. Aboard the Vessel, pumps shall be operationally tested with their  
3 respective systems in accordance with Section 101 of the Technical Specification.

4 Inspection shall be performed as defined in this Section and Sections 1 and 101 of the  
5 Technical Specification.

6 Pump coupling alignment shall be in accordance with manufacturers' recommendations after  
7 installation on-board and prior to pump operation.

#### 8 **73.10 PHASE II TECHNICAL PROPOSAL REQUIREMENTS**

9 See Section 100 of the Technical Specification for requirements regarding technical  
10 documentation.

#### 11 **73.11 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS**

12 See Section 100 for requirements regarding the provisioning of pump data with piping  
13 system calculations and other documentation requirements.

**(END OF SECTION)**